Designing a Systematic Review Pipeline

Protocol Development:
1. Research Question Formulation
2. Search Strategy:
   2.1. Database Selection
   2.2. Search String or Keywords Identification
3. Inclusion and Exclusion Criteria
4. Study Selection Process
5. Quality Assessment
6. Extraction and Synthesis of Data

Defining the Research Question:

1. **Primary Research Question:** How do the unique environmental constraints of unstructured, heterogeneous traffic and the dynamic behavioural signatures of egocentric motorcycle riding necessitate specific adaptations in deep learning architectures for robust, real-time perception?
2. **Secondary Research Question 01:** How do unstructured road environments in South Asia differ from standard structured datasets in terms of semantic ambiguity and class heterogeneity, and what is the impact on perception model performance?
3. **Secondary Research Question 02:** What are the unique behavioural signatures and sensor constraints of egocentric motorcycle vision compared to four-wheeled autonomous driving?
4. **Secondary Research Question 03:** Which deep learning architectures offer the optimal trade-off between real-time inference speed and robustness against ego-motion in resource-constrained edge devices?

Inclusion and Exclusion Criteria

1. **Inclusion Criteria**
   1.1. Studies written in English
   1.2. Studies that are complete
   1.3. Studies that are related to the defined research questions
   1.4. Studies published within a particular time period (Jan 2021 to November 2025)
   1.5. **Population/Vehicles:** Two-Wheelers (Motorcycles, Scooters, Bicycles)
   1.6. **Viewpoint:** First-Person View (Egocentric/Helmet Mounted/Head-Mounted)
   1.7. **Environment:** Unstructured / Chaotic / Ambiguous boundaries / lane-less traffic/ Unconstrained.
   1.8. **Location:** South Asia (India, Bangladesh)
2. **Exclusion Criteria**
   2.1. Studies written in languages other than English
   2.2. Studies that are not complete
   2.3. Studies that are irrelevant to our defined research questions
   2.4. Duplicate Studies
   2.5. **Population/Vehicles:** Any type of vehicles other than Motorcycles, Scooters, Bicycles
   2.6. **Viewpoint:** Third-Person (CCTV, Surveillance, Drone View)
   2.7. **Environment:** Structured/Highway
   2.8. **Location:** Any location other than South Asia

Search Strategy
1. **Search String:**
2. **Databases to Search:**
   a. Science Direct (Elsevier)
   b. Google Scholar

Study Selection Process:
1. List down all the studies applying the search string on the selected databases
2. Remove duplicate studies
3. Apply the inclusion and exclusion criteria to check the eligibility of the studies for our research questions
4. Review the abstract and conclusion of each study to check its eligibility.
5. Now go to data extraction.

Data Extraction Strategy: (What to find from each paper)

Field Category	Extraction Item	Why this matters (Source)
Context	Geographic Region	Does it cover South Asia (India/Bangladesh)?
	Unstructured Elements	Does it mention ambiguous boundaries or "Drivable Fallback"?
	Unique Classes	Does it include Rickshaws, Easy Bikes, or Animals?
Platform	Sensor Location	Helmet vs. Handlebar vs. Chest?
	Ego-Motion Handling	Does it use STEMM, Gyroscope, or Geometric constraints?
	Vibration Handling	Does it account for engine vibration/blur?
Dataset	Dataset Source	Is it a public, private, custom, or synthetically generated dataset?
	Type	Image/Video
	Size	Hours of video, number of frames/images
	Annotation Method	Fully Manual, Semi-Automated, …
	Labeling Strategy	hierarchical or normal
	Simulation Use	Use of Simulation for any cases especially on rare incidents?
Model / Architecture	Task	What is the model doing? (Object Detection, Semantic Seg., Trajectory Prediction, Maneuver Classification)
	Architecture	What is the backbone? (CNN / Transformer/ …)
	Hardware	Is it suitable for edge device deployment?

Extract information related to:
1. Challenges mentioned by the author of the paper
2. Dataset information
3. Model Information
   3.1. Task
   3.2. Architecture
   3.3. Hardware
   3.4. Parameter Information (Hyperparameter)
4. Performance Metric with result
5. Limitations mentioned by the author
6. year/publications

Base Search String:
("Egocentric" OR "First-Person Vision" OR "First-Person View" OR "Helmet-Mounted" OR "Head-Mounted") AND ("Motorcycle" OR "Motorbike" OR "Scooter" OR "Two-Wheeler" OR "Bike" OR "Rider") AND ("Unstructured" OR "Chaotic" OR "Heterogeneous" OR "Mixed Traffic" OR "Ambiguous" OR "Unconstrained" OR "South Asia" OR "India" OR "Bangladesh") AND ("Deep Learning" OR "DL" OR "CNN" OR "GAN" OR "Machine Learning" OR "ML")

Search Strings:
1. **Science Direct (Elsevier)**:
   1.1. ("Egocentric" OR "First-Person Vision") AND ("Motorcycle" OR "Two-Wheeler") AND ("Unstructured" OR "Chaotic" OR "Urban") AND ("Deep Learning" OR "Machine Learning")
   1.2. ("Helmet-Mounted" OR "Head-Mounted") AND ("Motorbike" OR "Scooter" OR "Road Scene") AND ("India" OR "Bangladesh") AND ("CNN" OR "GAN")
   1.3. ("First-Person View" OR "Egocentric") AND ("Bike" OR "Rider") AND ("Mixed Traffic" OR "Heterogeneous") AND ("Machine Learning" OR "Deep Learning")
   1.4. "Egocentric" AND ("Biker" OR "Two-Wheeler ") AND ("Ambiguous" OR "Unconstrained" OR "Street" OR "South Asia") AND ("Object Detection" OR "Trajectory")
2. **Google Scholar:**
   2.1. ("Egocentric" OR "Helmet-mounted") ("India" OR "Bangladesh") ("Motorcycle" OR "Two-wheeler") ("Deep Learning" OR "Machine Learning" OR "CNN" OR "GAN")
   2.2. ("Unstructured" OR "Chaotic" OR "Urban") ("Biker") ("Deep Learning" OR "Machine Learning")
   2.3. ("First-Person" OR "Head-mounted") ("Object Detection" OR "Trajectory") ("Motorcycle" OR "Rider") ("Deep Learning" OR "Machine Learning" OR "CNN" OR "GAN")
   2.4. ("Rider Behavior") ("Motorcycle") ("Egocentric" OR "Helmet-Mounted")

1.1 => Adnan —all
1.2, 1.3 => Oishi —all
1.4 => Amita—all
2.1, 2.4 => Sharif—all
2.2 => Afifa—90
2.3 => Habib